

IEEE P802.15 Working Group for Wireless Personal Area Networks

MAC Performance Evaluation Process in a Coexistence Environment

Nada Golmie

NIST

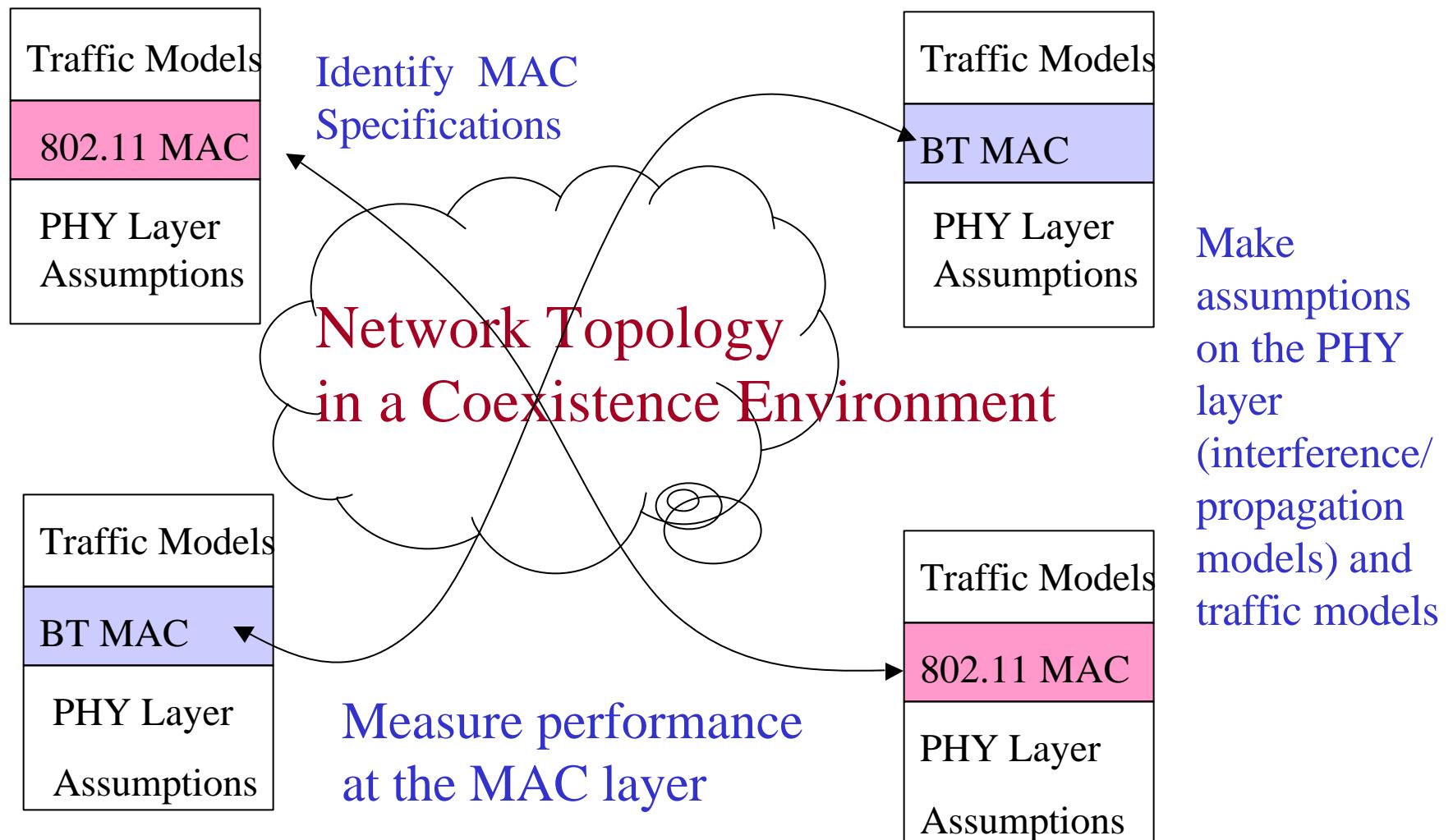
MAC Coexistence Model

- Different performance levels will lead to different levels of coexistence:
 - Coexistence could mean an “acceptable” performance level to be quantified.
- At the MAC layer coexistence translates into a performance measure:
 - What is the impact of interfering devices all sharing the 2.45 GHz ISM band on the MAC performance?
- How to evaluate and quantify WPAN MAC performance?

Objectives

- The main goal of this contribution is to propose a methodology for conducting a performance evaluation of the WPAN MAC in presence of other wireless devices sharing the same air space.
- The motivation is to agree on an evaluation process so that simulation/ experimental/ analysis results can be conducted independently by different parties and presented to the IEEE 802.15 SG.

MAC Performance Evaluation Set Up



MAC Coexistence Evaluation Process

The evaluation process of a given MAC layer protocol in a shared environment consists of:

- **Usage scenarios**

- User situations
- Applications

- **Parameters**

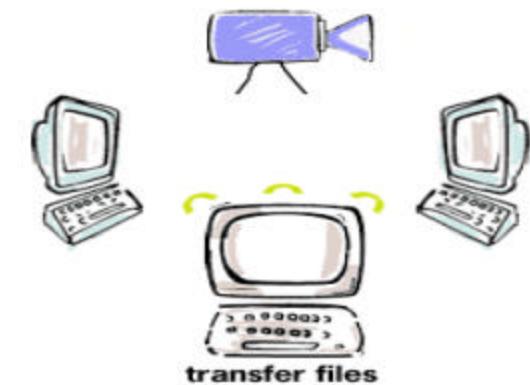
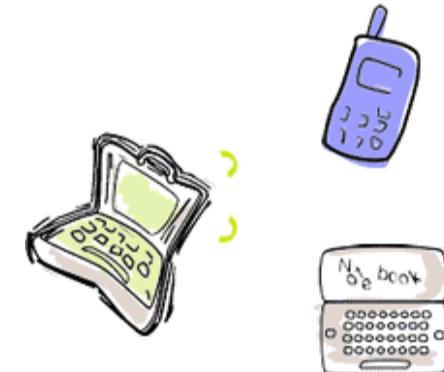
- Traffic generation models
- Network topology
- PHY layer assumptions
- MAC layer parameters

- **Performance metrics**

Bluetooth User Situations *

- Internet Bridge
- Interactive Conference
- Cordless Desktop
- Headset/Portable speaker phone
- Briefcase Trick
- Forbidden Message
- Automatic Synchronizer
- Instant Postcard

* www.bluetooth.com



IEEE 802.11 User Situations

- The Basic Service Set (BSS) consists of:
 - Access Points (AP)
 - Wireless Stations (STA)
- Need to consider *:
 - STAs density per area
 - AP density per area
 - Number of STAs per AP

* refer to IEEE 802.15-99/073r0

Coexistence User Situations

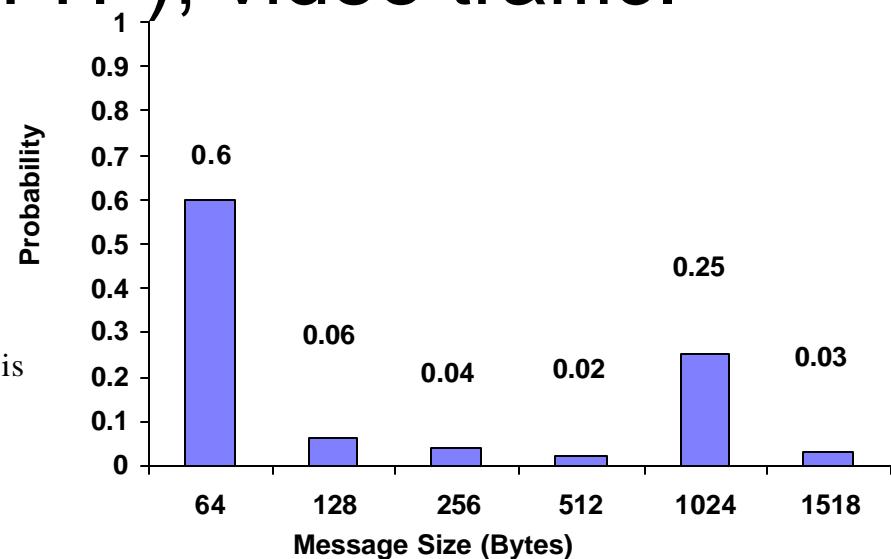
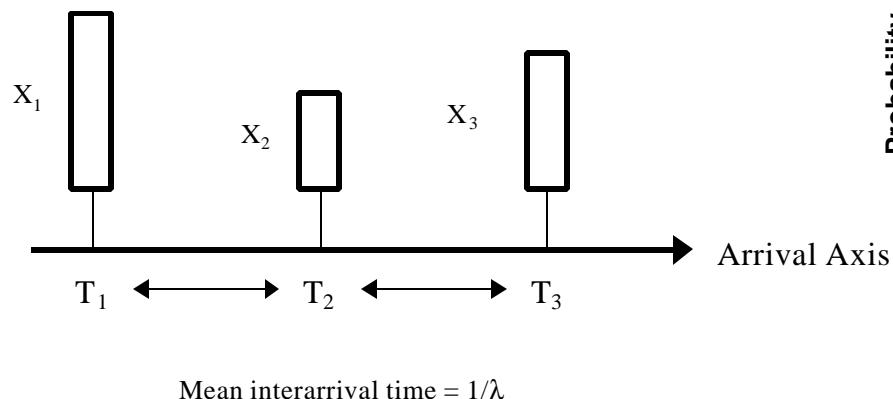
- Office space situations
 - desktop, interactive conference,
 - automatic synchronizer, headset
- Dynamic situations (anywhere else)
 - internet bridge
 - instant postcard
 - forbidden message

Applications

- Telephony
- Email
- Web Browsing
- File Transfer
- Paging
- Video Conferencing

Traffic Generation Models

- Traffic models that describe the distribution of the message size and interarrival time are derived from the application set considered.
- Many traffic models exist in the literature for voice, data (FTP, HTTP), video traffic.



Illustrations from IEEE 802.14/96-083r2

Network Topology

- Number of devices in a piconet
- Distance among devices in a piconet
- Number of piconets

Physical Layer Parameters and Assumptions

- Frequency hopping
- Interference model
 - Power level
 - BER
 - Overlapping probability
- Propagation model
 - Path loss

MAC Layer Parameters

- Contention slot allocation
- Slot scheduling algorithm
- Timers: Flush, ACK
- Packet size/compression
- Backoff algorithm:
 - contention window size (max, min)

Performance metrics

- Access delay (mean, variance, PDF):
 - time to transmit a message
- Collisions per slot
 - average number of collisions per slot
- Offered Load
 - actual traffic presented to the network for transmission in bits/s
- Throughput
 - Measure in bits/s of the successful traffic transmitted excluding MAC and PHY overhead.

Summary

- Propose a methodology for MAC coexistence model evaluation.
- List major components and provide examples for parameters, user situations, and performance metrics.
- Details within each components are work in progress

Next Step

- Let's start the debate
- Agreement on this evaluation process
- Solicit input to complete
 - Usage situations
 - Network Topology
 - Parameters

